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ABSTRACT

Predictor-criterion relationships for cognitive, non-cognitive, and cross-product predictors were analyzed using criteria constructed for the curriculum units within the following grade complexity levels: cumulative, division, department, and course. Analyses of the correlations were performed in an attempt to inquire into the complexity of the cumulative GPA and its potential for masking relationships at the other levels. The results suggested that differential relationships do exist for the less complex sub-criteria; that these relationships characterize various groupings of curriculum units; and that these relationships may be masked at the cumulative level. (Author)

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DIFFERENTIAL RELATIONSHIPS WITH GRADE CRITERIA FOR PREDICTORS AT VARYING LEVELS OF FRESHMAN GRADE COMPLEXITY[1,2]

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Many prediction studies in higher education research have utilized cognitive and non-cognitive predictors for the purpose of predicting academic achievement in college. The bulk of the major studies have been summarized by Astin (1971), Fishman and Pasanella (1960), Lavin (1965), and Stein (1963). For cognitive predictors, multiple relationships with college achievement have been shown to be of sufficient magnitude to warrant the use of these predictors in college selection procedures. When Scholastic Aptitude Test scores (SAT-V and SAT-M) and High School Average (HSA) are used as predictors of first-year cumulative Grade-Point Average (GPA), multiple $\underline{R}$'s have typically ranged between .30 and .70. While multiple $\underline{R}$'s in the vicinity of .70 have led to the termination of grade prediction research programs, multiple $\underline{R}$'s in the vicinity of .30 have led to further research designed to improve the predictability of college achievement.

Besides efforts to improve sampling procedures and experimental designs, attempts to improve the predictability of college achievement have most frequently focused on one approach, that of improving the predictor battery. The various facets of this approach have included the testing of higher-order predictor models, input adjustment models, and moderator models, as well as the search for non-cognitive predictors that are more than just merely convenient. Research into the criterion of academic achievement has, until recently, received little attention.

The various facets of this approach have included the study and questioning of grading standards, output adjustment models, and grade complexity research. (Central prediction models, in adjusting both input and output measures, appear to be hybrids of both the predictor and criterion approaches.)

The study of grade complexity, in particular, has been relatively untapped. Beginning with a series of studies by French (French, 1951, 1963; French, Tucker, Newman, & Bobbitt, 1952), only a few studies have subsequently followed this line of research (Webb, 1967; Boldt, 1970). Perhaps the most general conclusion that can be drawn from these various studies is that relationships between a cumulative GPA criterion and cognitive or non-cognitive predictors may mask predictor-criterion relationships that exist within the curriculum units of the less complex levels of grade criteria, e.g., the division, department, and course levels.

The interest of the present study was to inquire further into predictor-criterion relationships at the division, department, and course levels. Cognitive, non-cognitive, and cross-product (cognitive by non-cognitive) predictors were studied in order to determine the extent of two types of masking at the level of the cumulative GPA. The two types of masking are: cancellation, occurring when a statistically non-significant correlation with cumulative GPA fails to reflect the large number of statistically significant correlations with less complex grade criteria; and exaggeration, occurring when a statistically significant correlation with cumulative GPA fails to reflect the small number of statistically significant correlations with less complex grade criteria. Grading pattern similarity coefficients among curriculum units of the division and department levels were also analyzed as an aid to

understanding the differential predictor-criterion relationships.

Method

Subjects

Twelve-hundred and thirty-six freshmen who entered the Emory University College of Arts and Sciences in the Fall quarters of 1966 and 1967, completed at least one course, and for whom scores were available on the measuring instruments were used for the analyses. This sample constituted over 96% of the two entering freshman classes.

Measures

The predictor measures consisted of: (a) 3 cognitive predictors, including SAT-V, SAT-M, and HSA; (b) 31 non-cognitive predictors, including 11 scales from the Opinion, Attitude and Interest Survey (OAIS), 7 standard scales from the College Student Questionnaire Part 1 (CSQ), 12 scales derived from a factor analysis of the CSQ, and the variable Sex (M = 1, F = 2); and (c) 9 cross-product predictors, derived from various combinations of cognitive and OAIS non-cognitive predictors in order to represent areas of interaction between adjustment, aptitude, interest, and motivation. The non-cognitive measures were administered during freshman placement testing.

A total of 85 criterion variables were derived from the curriculum units of four levels of grade complexity: (a) cumulative GPA; (b) 3 divisional GPA's; (c) 21 departmental GPA's; and (d) course grades from 60 courses. The 3 divisions were Humanities, Natural Science, and Social Science. The 21 departments, with the numbers of courses in parentheses, were Biology (4), Chemistry (4), Economics (1), English (3), French (6), Geology (3), German (4), History (2), History of Art (1), Humanities (1), Latin (3), Mathematics (9), Music (1), Philosophy (2), Physics (1), Political Science (2), Psychology (1), Religion (2),

Russian (3), Sociology (1), and Spanish (6). With the large number of courses required within the first two years, many of the students followed similar curricula, but with slightly different sequencing.

Analyses

For each of the 85 grade criteria, zero-order product-moment correlations with each of the 43 predictors were calculated. In addition, multiple R's and partial correlations were calculated within each of the four sets of predictors: (a) 3 cognitive; (b) 31 non-cognitive; (c) 9 cross-product; and (d) 43 total set. The latter statistics were calculated only if a minimum of 30 df remained after fitting all of the predictors.

At the division, department, and course levels, four sets of analyses were performed. (a) Equality of regression equations among the units for each of the four sets of predictors was tested by F ratios (Rao, 1965). (b) χ^2 tests, based on the approximately normal distribution of Fisher's r-z transformation (David, 1938), were made in order to compare the zero-order correlations among the units for each of the 43 predictors. (c) Tabulations were made of the significantly correlated ($p<.05$) predictors for the zero-order correlations and the partial correlations within each of the four predictor sets. (d) The Horst "differential prediction technique" (Horst, 1954) was used to determine the predictors that were most differentially associated with the grade criteria.

Two general problems were encountered in the above analyses. The first two sets of analyses, although intended for independent samples, were used with dependent samples, and thus had to be interpreted as conservative tests (more statistically significant differences would have been found if the dependence among the samples had been taken into

account). By assuming that the dependence among samples had similar effects on the χ^2 analyses for all 43 predictors, it was possible to rank-order the magnitudes of the χ^2 values and to use the rank-ordered values as relative indices of differential relationship among the predictors. Second, the first three sets of analyses had to be interpreted cautiously because these analyses failed to take into account the correlations among the 43 predictors or among the three sets of predictors. Therefore, the partial correlations were inspected in order to subjectively assess the effects of the overlap among the 43 predictors on the different analyses.

Compounding the above problems were several difficulties in the use of the Horst technique. First, since the zero-order correlations used by this technique are implicitly assumed to have been derived from reasonably equal-sized samples, curriculum units were analyzed at each grade complexity level if a minimum of 100 observations were available. For this reason, besides the 3 divisions, only 15 departments and 28 courses were analyzed by the Horst technique. Second, since the Horst technique operates by a forward stepwise procedure, with an unknown distribution for the Δ statistic (the index of increased differential prediction), the only meaningful data from this technique are the rank-ordered entrance steps. However, since the decision to enter a predictor into the subset of differential predictors cannot be reversed, it is possible that the early entrance of some predictors, by inhibiting the early entrance of other predictors, may lead to a non-optimum rank-ordering of entrance steps for a subset of specified size. To minimize these problems, it was necessary to use in conjunction the results of both the χ^2 tests and the Horst technique. A predictor was considered to be "differential" if both the magnitude of its χ^2 value

and its entrance into the differential predictor subset of the Horst technique were, arbitrarily, among the top third.

Definitions of exaggeration and cancellation were as follows. Exaggeration was defined to occur for a predictor at a given level of grade complexity if (a) its correlation with cumulative GPA was statistically significant, (b) differential prediction was indicated on the basis of both a relatively extreme χ^2 and early entrance into the Horst solution (top 14 predictors in both techniques), and (c) a low percentage of significant r's (arbitrarily, 50% or less) between predictor and grade criteria was obtained from the curriculum units. Cancellation was defined to occur for a predictor at a given level of grade complexity if (a) its correlation with cumulative GPA was statistically non-significant, (b) differential prediction was indicated on the basis of both a relatively extreme χ^2 and early entrance into the Horst solution (top 14 predictors in both techniques), and (c) a high percentage of significant r's (arbitrarily, more than 50%) between predictor and grade criteria was obtained from the curriculum units.

As a means of grouping curriculum units on the basis of similarity of correlations between grade criteria and predictors, additional analyses involved varimax-rotated principal components analyses of the intercorrelations among the curriculum units for the division and department levels. The intercorrelations among units (grading pattern similarity coefficients) were obtained by calculating product-moment correlations across the r-z transformations of correlations between each of the 43 predictors and the appropriate grade criterion. Since the "observations" in these analyses were not independent, the results had to be interpreted cautiously.

Results

Based on 998 observations, the multiple $\underline{R}$'s between cumulative GPA and the four sets of predictors were: cognitive, .51; non-cognitive, .47; cross-product, .37; and total set, .60. Of the 12 $\underline{F}$ ratios calculated to assess the equality of the regression equations at the lower levels of grade complexity, all were statistically significant at the .01 level. Thus, multiple relationships were found to differ among the curriculum units for every level of grade complexity and for every set of predictors. According to the χ^2 analyses of the zero-order correlations, 27 predictors were found to differ significantly among the curriculum units of at least one of the grade complexity levels: 8 predictors for all three levels; 9 predictors for two levels; and 10 predictors for one level.

Tabulation of the partial correlations within the three sets of predictors and within the total set proved inconsistent and difficult to interpret across the four levels of grade complexity. On the other hand, tabulation of the statistically significant zero-order correlations clearly suggested that the results for the cumulative level were not representative of the results for the units of the lower levels of grade complexity. The few exceptions were obtained for correlations between cumulative GPA and High School Average, three non-cognitive measures of motivation (Achiever Personality, Motivation for Grades, and Academic Motivation), and one cross-product predictor (Ability by Motivation).

Table 1 summarizes for each predictor the zero-order correlation

Insert Table 1 about here

with cumulative GPA, and at each of the other three levels the rank of

the magnitude of the χ^2 test, the entrance step in the Horst technique, and various counts of the numbers of units in which statistically significant zero-order correlations with grade criteria were obtained. For each predictor at each level, the counts summarize for a statistically significant correlation at the cumulative level (a) the number of units in which statistically significant correlations were obtained in the same direction, and (b) the number of units in which statistically significant correlations were obtained in the opposite direction, or for a statistically non-significant correlation at the cumulative level (c) the number of units in which statistically significant correlations were obtained.

According to the definitions used in this study, one case of cancellation and nine cases of exaggeration were identified from Table 1. Independent-Artistic-Literary Interest, which was cancelled at the cumulative level, was negatively related to divisional grades in Natural Science and positively related to Social Science and Humanities grades. The predictors SAT-Mathematics, Sex, and Verbal Ability by Humanities Interest had relationships at both the department and course levels that were exaggerated at the cumulative level. SAT-Mathematics had positive correlations with grade criteria in the natural science and language departments and courses. Sex (M = 1, F = 2) had positive correlations with grade criteria in the language and humanities departments and courses, and Verbal Ability by Humanities Interest had positive correlations with grade criteria in the humanities departments and courses. The three remaining cases of exaggeration were for Preference for Academia at the department level and SAT-Verbal and Humanities Interest at the course level. Most noteworthy of these last three cases was the lack of statistically significant correlations

between SAT-Verbal and grades in the various language courses.

According to the components analysis of the grading pattern similarity coefficients among divisions, two rotated components, accounting for 97% of the variance, were named Humanities-Social Science and Natural Science. From the departmental level, four rotated components accounted for 81% of the variance. The department components, with departments loading above .30 in parentheses, were: Language (Russian, Music, Spanish, Mathematics, and French); Humanities (Latin, Philosophy, English, and Sociology); Natural Science (Physics, Chemistry, and Biology); and Humanities-Social Science (History of Art, Humanities, Political Science, History, and Music, with Music negative). These rotated components suggest groupings of divisions and departments in which similar correlations with grade criteria were obtained for the predictors.

Of particular interest in the components analysis was the construction of component scores as a means of identifying the predictors with the greatest saturation of the various components. Rank-orders of the absolute magnitudes of the component scores for each predictor are presented in Table 2. The signs attached to the ranks in this table

Insert Table 2 about here

indicate the relative direction of the predictor-criterion correlations in each grouping. In the following interpretation of the component scores, the technical terms usually associated with components analysis are presented in parentheses. Any predictor (observation) that is highly ranked on a particular grouping of curriculum units (component) has relatively high correlations with grade criteria (scores) in the curriculum units (variables) defining that grouping (component). An example

should help to clarify the interpretation. High School Average, with one exception, had the highest component scores on the division and department components, and the signs of the component scores were positive in all cases. This indicates the relative overall importance of High School Average, in a positive direction, for predicting grade criteria in the several groupings of divisions and departments.

Inspection of Table 2 should help to clarify some of the findings noted earlier. For the most consistently correlated predictors across all analyses (High School Average, Achiever Personality, Motivation for Grades, Academic Motivation, and Ability by Motivation), the high scores on most of the curriculum unit groupings suggest the high predictive utility of these measures. Alternatively, on the basis of discrepancies of rank and sign across the component scores, it is possible to identify the inconsistent, relatively differential, predictors at each level. At the division level, large discrepancies were shown for SAT-Mathematics and Independent-Artistic-Literary Interest, while at the department level large discrepancies were shown for SAT-Mathematics and Physical Science Interest. As noted in the earlier analyses, relationships with cumulative GPA were considered to have exaggerated relationships for SAT-Mathematics at the department (and course) level and to have cancelled relationships for Independent-Artistic-Literary Interest at the division level.

Discussion

The results of this study demonstrate the complexity of the cumulative GPA as a measure of academic achievement in college. Given the constraints of the analyses, and the inadequacy of analytic techniques to handle some of the research questions, various "weak" conclusions can be drawn. The conclusions are "weak" insofar as they rely upon the

matching of results from several techniques on the basis of arbitrary cut-r[illegible] than probability statements generated from known s[illegible] di[illegible] ations. The conclusions are that differential relationships between predictors and grade criteria exist at the less complex levels of grade complexity; that these relationships characterize various groupings of curriculum units; and that some of these relationships may be masked by cancellation or exaggeration at the level of the cumulative GPA.

If the predictors are conceptualized as general academic predictors or specific academic predictors (some, it can be argued, are neither), rather than as cognitive or non-cognitive predictors, then the occurrence of masking at some of the grade complexity levels can be more easily understood. According to the several techniques employed, masking at the cumulative level more likely occurred for the specific academic predictors. General academic predictors, such as High School Average, which is in itself a complex composite, in addition to measures of motivation and the cross-product of ability and motivation, showed consistent, relatively non-differential, relationships with grades at all levels of grade complexity.

The results of this study suggest two alternative approaches to improving the prediction of academic achievement. On one hand, it would seem reasonable to predict cumulative GPA with predictor batteries that have been improved through the addition of general academic predictors. This approach, however, may yield limited improvements in prediction since the predictive gains may be nullified by the overlap among the general academic predictors. On the other hand, it may be more fruitful to add both general and specific academic predictors to the predictor battery and to develop models for the prediction of academic achievement via the prediction of sub-criteria that are less complex than cumulative GPA.

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Footnotes

[1]This study is based on a doctoral dissertation submitted in partial fulfillment of the requirements for the PhD degree at Emory University. Appreciation is extended to Norman P. Uhl for his aid rendered throughout all stages of the study.

[2]Paper read at the annual meeting of the National Council on Measurement in Education, New Orleans, 1973.

Table 1

Zero-Order Correlations with Cumulative GPA and Summary of Three Sets of Analyses for Division, Department, and Course Grade Criteria

Predictor	r with Cum. GPA	Divisions					Departments					Courses				
		Ranks		Counts			Ranks		Counts			Ranks		Counts		
		χ^2	H	a	b	c	χ^2	H	a	b	c	χ^2	H	a	b	c
1. SAT-Verbal	.22**	14	8	3	0		2	6	13	0		1	1	19	0	
2. SAT-Mathematics	.18**	2	1	2	0		1	1	5	1		6	2	15	1	
3. High School Average	.48**	12	17	3	0		14	28	19	0		8	9	48	0	
4. Achiever Personality	.26**	16	27	3	0		37	31	14	0		36	15	30	0	
5. Intellectual Quality	.14**	20	16	3	0		9	37	4	0		14	36	8	0	
6. Creative Personality	-.10*	23	32	2	0		8	43	3	1		9	32	12	1	
7. Social Adjustment	.01	43	30			0	29	34			1	17	18			5
8. Emotional Adjustment	-.01	18	37			0	41	25			0	41	39			0
9. Masculine Orientation	-.02	10	7			1	34	11			2	32	19			5
10. Business Interest	-.11**	25	33	2	0		26	18	7	0		22	34	10	1	
11. Humanities Interest	.07*	6	34	1	0		7	36	5	1		7	11	8	3	
12. Social Science Interest	.03	26	13			0	31	24			2	27	21			4
13. Physical Science Interest	.06	13	42			1	20	39			3	10	30			10
14. Biological Science Interest	.07*	34	15	2	0		43	38	4	0		42	29	3	0	
15. Family Independence	-.10*	38	19	2	0		19	23	3	0		15	26	9	1	

Table 1 (cont'd)

Predictor	r with Cum. GPA	Divisions					Departments					Courses				
		Ranks		Counts			Ranks		Counts			Ranks		Counts		
		x^2	H	a	b	c	x^2	H	a	b	c	x^2	H	a	b	c
16. Peer Independence	.06*	40	41	1	0		13	42	4	1		19	31	6	4	
17. Liberalism	.07*	36	18	1	0		16	17	3	1		21	41	7	2	
18. Social Conscience	.15**	15	40	3	0		15	9	8	0		16	42	16	0	
19. Cultural Sophistication	-.01	7	39			1	5	12			5	4	14			13
20. Motivation for Grades	.32**	31	35	3	0		21	20	18	0		20	7	38	0	
21. Family Social Status	-.06	37	38			0	32	21			4	33	38			5
22. Academic Motivation	.27**	32	36	3	0		22	19	17	0		25	8	35	0	
23. Educational-Cultural-Economic Level	-.07*	33	9	2	0		23	40	3	1		34	40	6	0	
24. Independent-Artistic-Literary Interest	.01	5	6			3	3	5			7	2	35			13
25. School Social Orientation	-.01	22	21			0	17	7			2	13	12			8
26. Political Orientation	-.02	28	24			0	10	10			4	12	6			7
27. Business Orientation	.01	30	5			0	25	4			2	29	5			5
28. Parental Academic Concern	.00	21	23			0	42	41			1	40	27			0
29. Preference for Academia	.14**	9	3	2	0		11	3	6	0		37	4	5	0	
30. Parental Financial Status	-.11**	41	25	3	0		40	8	6	0		39	37	7	0	
31. Self vs. Intellectual Concern	-.03	24	31			0	28	16			4	35	33			3
32. Science vs. Humanities Interest	.02	8	10			1	18	22			3	38	28			1

Table 1 (cont'd)

Predictor	r with Cum. GPA	Divisions Ranks χ^2	Divisions Ranks H	Divisions Counts a	Divisions Counts b	Divisions Counts c	Departments Ranks χ^2	Departments Ranks H	Departments Counts a	Departments Counts b	Departments Counts c	Courses Ranks χ^2	Courses Ranks H	Courses Counts a	Courses Counts b	Courses Counts c
33. College-Oriented Secondary School	-.06	35	26			1	39	15			2	43	43			1
34. Sex	.20**	1	2	3	0		4	2	9	1		3	3	17	2	
35. Ability by Motivation [{1+2} x 4]	.31**	17	28	3	0		35	32	15	0		31	16	30	0	
36. Ability by Social Adjustment [{1+2} x 7]	.04	42	20			0	30	35			1	18	17			7
37. Motivation by Social Adjustment [4 x 7]	.14**	39	22	3	0		38	27	10	0		26	13	14	1	
38. Verbal Ability by Humanities Interest [1 x 11]	.11**	4	12	2	0		6	13	6	0		5	10	10	1	
39. Ability by Social Science Interest [{1+2} x 12]	.06*	29	29	2	0		33	26	2	0		13	20	3	1	
40. Mathematical Ability by Natural Science Interest [2 x {13+14}]	.12**	19	43	2	0		24	14	6	0		14	23	9	1	
41. Motivation by Humanities Interest [4 x 11]	.20**	3	4	3	0		12	33	11	0		11	24	18	0	
42. Motivation by Social Science Interest [4 x 12]	.18**	11	11	3	0		27	30	10	0		23	25	16	0	
43. Motivation by Natural Science Interest [4 x {13+14}]	.17**	27	14	3	0		36	29	11	0		30	22	19	0	

Note.--Quantities summarized in this table are based on analyses of zero-order correlations with predictors and grade criteria. Under "Ranks," the "χ^2" column lists the ranked magnitudes of the χ^2 tests among correlations,

Table 1 (cont'd)

and the "[illegible]" column lists the entrance steps into the differential predictor subset of the Horst technique. Under "Counts": the "a" column lists the number of units in which a statistically significant correlation was obtained in the same direction as the statistically significant correlation with cumulative GPA; the "b" column lists the number of units in which a statistically significant correlation was obtained in the direction opposite to that of the statistically significant correlation with cumulative GPA; and the "c" column lists the number of units in which a statistically significant correlation was obtained when the correlation with cumulative GPA was not statistically significant.

Table 2

Rank-Order, with Signs, of Absolute Magnitudes of Division and Department Component Scores from Analyses of Grading Pattern Similarity Coefficients

	Divisions		Departments			
Predictor	H-SS	NS	Lang	Hum	NS	H-SS
1. SAT-Verbal	7	19	28	3	14	26
2. SAT-Mathematics	-33	3	27	-32	2	- 5
3. High School Average	1	1	1	2	1	1
4. Achiever Personality	9	8	8	9	12	27
5. Intellectual Quality	23	38	41	18	36	23
6. Creative Personality	-10	- 5	- 2	-23	-21	32
7. Social Adjustment	-24	-36	29	- 8	-22	-28
8. Emotional Adjustment	-28	-22	-40	-16	-17	-37
9. Masculine Orientation	-14	-41	-19	- 6	39	42
10. Business Interest	- 4	-15	-16	- 1	-35	- 6
11. Humanities Interest	42	-24	-26	27	-32	14
12. Social Science Interest	-38	-27	-37	-24	-27	21
13. Physical Science Interest	-22	26	-35	-36	7	- 8
14. Biological Science Interest	41	-40	30	43	-38	-31
15. Family Independence	- 8	-10	- 6	-22	-34	-19
16. Peer Independence	-37	-39	-22	29	26	-34
17. Liberalism	-36	-43	-17	35	23	-39
18. Social Conscience	19	35	24	34	-24	33
19. Cultural Sophistication	-32	- 9	-13	41	- 3	38
20. Motivation for Grades	2	2	3	10	6	2
21. Family Social Status	-13	-14	-10	-28	-18	-18
22. Academic Motivation	3	6	4	26	15	3

Table 2 (cont'd)

Predictor	Divisions H-SS	Divisions NS	Departments Lang	Departments Hum	Departments NS	Departments H-SS
23. Educational-Cultural-Economic Level	-12	-12	-11	-20	-19	43
24. Independent-Artistic-Literary Interest	39	-13	-21	33	-10	20
25. School Social Orientation	-30	-21	43	-12	- 4	-41
26. Political Orientation	-25	-20	-12	-37	-11	-40
27. Business Orientation	-20	-29	-33	-40	-16	- 4
28. Parental Academic Concern	-26	-23	-31	-21	-33	-36
29. Preference for Academia	35	33	38	17	-29	-16
30. Parental Financial Status	- 6	- 7	- 7	- 7	-20	-17
31. Self vs. Intellectual Concern	-16	-30	-20	-15	40	-15
32. Science vs. Humanities Interest	-31	-17	-39	38	- 8	- 9
33. College-Oriented Secondary School	-15	-11	-18	-11	-30	-12
34. Sex	18	32	14	19	-28	25
35. Ability by Motivation [{1+2} x 4]	5	4	5	4	5	24
36. Ability by Social Adjustment [{1+2} x 7]	-34	-42	25	-13	-31	-29
37. Motivation by Social Adjustment [4 x 7]	21	25	9	-42	-42	35
38. Verbal Ability by Humanities Interest [1 x 11]	29	-34	-32	14	-41	13
39. Ability by Social Science Interest [{1+2} x 12]	-43	-37	-42	-30	-37	22
40. Mathematical Ability by Natural Science Interest [2 x {13+14}]	-40	18	36	39	9	-11
41. Motivation by Humanities Interest [4 x 11]	17	28	34	5	25	10
42. Motivation by Social Science Interest [4 x 12]	11	31	15	31	43	7
43. Motivation by Natural Science Interest [4 x {13+14}]	27	16	23	25	13	-30